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Advanced Life Support Project: Crop Experiments at Kennedy Space Center

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ABSTRACT:

Crop production systems provide bioregenerative technologies to complement human crew life support requirements on long duration space missions. Kennedy Space Center has lead NASA's research on crop production systems that produce high value fresh foods, provide atmospheric regeneration, and perform water processing. As the emphasis on early missions to Mars has developed, our research focused on modular, scalable systems for transit missions, which can be developed into larger autonomous, bioregenerative systems for subsequent surface missions. Components of these scalable systems will include development of efficient light generating or collecting technologies, low mass plant growth chambers, and capability to operate in the high energy background radiation and reduced atmospheric pressures of space. These systems will be integrated with air, water, and thermal subsystems in an operational system. Extensive crop testing has been done for both staple and salad crops, but limited data is available on specific cultivar selection and breadboard testing to meet nominal Mars mission profiles of a 500-600 day surface mission. The recent research emphasis at Kennedy Space Center has shifted from staple crops, such as wheat, soybean and rice, toward short cycle salad crops such as lettuce, onion, radish, tomato, pepper, and strawberry. This paper will review the results of crop experiments to support the Exploration Initiative and the ongoing development of supporting technologies, and give an overview of capabilities of the newly opened Space Life Science (SLS) Lab at Kennedy Space Center. The 9662 m²(104,000 ft²) SLS Lab was built by the State of Florida and supports all NASA research that had been performed in Hanger-L. In addition to NASA research, the SLS Lab houses the Florida Space Research Institute (FSRI), responsible for co-managing the facility, and the University of Florida (UF) has established the Space Agriculture and Biotechnology Research and Education (SABRE) Center with several faculty.

Keywords: plant lighting, cultivar selection, volatile organic contaminants, nutrient delivery, research facilities